Acta Zootaxonomica Sinica, 32 (4): 865–874 (Oct., 2007) ISSN 1000-0739
动物分类学报

# 内蒙古道虎沟中侏罗世中生蝎蛉科 (昆虫纲, 长翅目) 昆虫化石新发现

孙建海 任 东* 史宗冈
首都师范大学生命科学学院 北京 100037

摘 要 描述中生蝎蛉科 Mesopanorpodidae Tillyard, 1918 化石 2 新属 3 新种: 宽翅柱状蝎蛉 *Stylopanorpodes eurypterus* gen. *et* sp. nov., 华美纺锤蝎蛉 *Netropanorpodes decorosus* gen. *et* sp. nov., 多刺纺锤蝎蛉 *Netropanorpodes sentosus* gen. *et* sp. nov.。所有化石标本均采于内蒙古宁城道虎沟中侏罗世九龙山组地层, 模式标本现保存于首都师范大学生命科学学院。

关键词 长翅目, 中生蝎蛉科, 新属, 新种, 道虎沟, 中侏罗世.
中图分类号 Q915.819.7

中生蝎蛉科 Mesopanorpodidae Tillyard, 1918 是长翅目中的一个灭绝科, Martynova (1962) 曾将该科并入 Permochoristidae, 但后者 M 脉分支较多, 两者差异较大, 后仍作为一个独立的科 (Ren, 1995)。该科目前已知有 11 属: *Mesopanorpodes* Tillyard, 1918; *Prochoristella* Riek, 1953; *Afristella* Riek, 1974; *Itaphlebia* Sukatsheva, 1985; *Chrysopanorpa* Ren, 1995; *Erdosia* Hong, 2002; *Triassochoristites* Hong & Guo, 2003; *Forainerva* Hong & Guo, 2003; *Longifurcula* Hong, 2007; *Allochorista* Hong, 2007; *Ladinochorista* Hong, 2007。Novkshonov (1997) 将 *Itaphlebia* Sukatsheva, 1985 和 *Chrysopanorpa* Ren, 1995 合并为一个属 *Itaphlebia*, 并将其归入小蝎蛉科 Nannochoristidae 中, 但由于该科已经灭绝, 且所发现的种类较少, 这一划分尚未得到认可, 关于这两属的具体分类还有待进一步的研究。中生蝎蛉科是长翅目中比较古老的类群之一, 地史纪录上最早出现于晚二叠世, 与长翅目中的 Mesochoristidae 亲缘关系较近 (Riek, 1953), Willmann (1987) 认为该科和来自澳大利亚早二叠世的 Xenochoristidae, 三叠纪的 Triassochoristidae 可能为长翅目中异源的复系群, 代表着比小蝎蛉科 Nannochoristidae 更早的分支。

我们自内蒙古宁城道虎沟的九龙山组 (Jiulongshan Formation) 地层中采到大量的昆虫化石 (Liu *et al*., 2006; Yao *et al*., 2006; Zhang *et al*., 2006), 其中包括本文的 3 种中生蝎蛉科化石。化石的地质时代应归为中侏罗世 (Ren *et al*., 2002; Tan *et al*., 2006)。

本文化石的鉴定和初步描绘主要借助于 Leica MZ12.5 显微镜附带绘图仪辅助完成, 部分线条图借助于 CorelDraw 12 绘图软件完成。

## 长翅目 **Mecoptera Packard, 1886**

### 中生蝎蛉科 **Mesopanorpodidae Tillyard, 1918**

Mesopanorpodes Tillyard, 1918. *Proc. Linn. Soc. N. S. Wales*, 42: 720-756.

Mesopanorpodidae Riek, 1953. *Rec. Aust. Mus.*, 23: 55-87.

Mesopanorpodidae Riek, 1974. *Paleontol. Africana*, 17: 19-31.

Mesopanorpodidae Sukatsheva, 1985. *Trudy Paleontol. Inst. Akad. Nauk SSSR* 211. Nauka, Moscow: 96-114.

Mesopanorpodidae Jell, and Duncan, 1986. *Mem. Ass. Australas. Palaeontols*, 3: 111-205.

Mesopanorpodidae 任东等, 1995. 北京与邻区侏罗–白垩纪动物群及其地层. 91~94.

Mesopanorpodidae Hong, Guo and Wang, 2002. *Acta Zootax. Sin.*, 27 (2): 278-283.

科征 前翅相对较宽, Sc 脉延伸到翅痣区域, M 脉基部与 CuA 脉愈合, Rs 脉和 M 脉均有 4 个分支。

分布: 澳大利亚, 南非, 西伯利亚, 中国; 晚二叠世—早白垩世。

### 柱状蝎蛉属, 新属 Stylopanorpodes **gen. nov.**

模式种: *Stylopanorpodes eurypterus* gen. *et* sp. nov.

鉴别特征 虫体中等, 喙细长, 复眼大。足细长, 其上被有排列不规则的细毛。前翅宽大, 翅痣不明显, Sc 脉长, 2 分支, 伸达翅痣区域; $R_1$ 不分支, Rs 脉 4 分支, 在翅中点之前分叉, $R_{4+5}$ 分叉早

国家自然科学基金 (30370184, 30430100)、北京市自然科学基金 (5032003)、北京市教育委员会科技发展计划重点项目 (KZ200410028013) 和北京市市属市管高等学校拔尖创新人才项目共同资助.

* 通讯作者, E-mail: rendong@mail.cnu.edu.cn

收稿日期: 2006-12-25, 修订日期: 2007-07-23.

于 $R_{2+3}$。M 脉 4 分支，分叉晚于 Rs 脉，$M_{3+4}$ 早于 $M_{1+2}$ 分叉，但晚于 $R_{4+5}$。CuA 和 M 脉在基部愈合较长一段距离，两脉形成的 Y 形脉明显。CuP 和 1A 脉之间有 2 支横脉。腹部延长，圆柱状，末端变细，雌虫有 11 腹节。

比较　从翅脉来看，*Stylopanorpodes* gen. nov. 与 *Mesopanorpodes* Tillyard, 1918 和 *Prochoristella* Riek, 1953 类似，但新属与前者最大的区别在于 $R_{4+5}$ 分叉早于 $R_{2+3}$，CuP 和 1A 脉之间有 2 支横脉；与后者的区别在于 Rs 脉分叉早于 M 脉，$R_{2+3}$ 分离晚，$R_2$ 和 $R_3$ 都较短，CuA 和 CuP 脉之间的横脉缺失。新属的 Rs 脉和 M 脉的分叉方式，以及 Rs 和 M 脉区域的横脉退化与其他属截然不同。

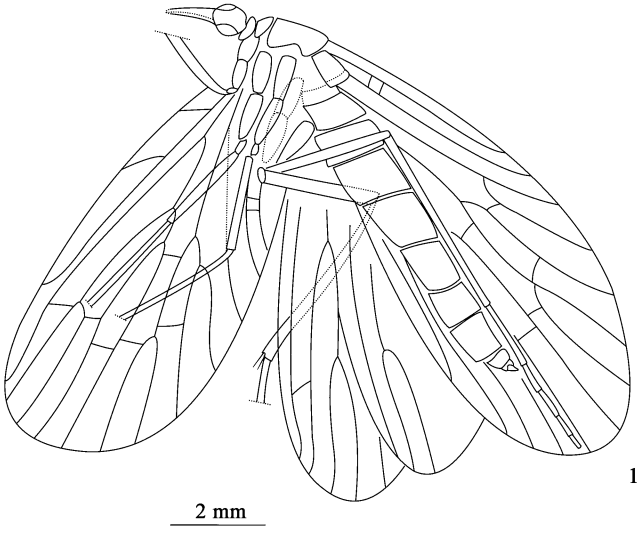
词源：Stylopanorpodes 源于希腊词 *styl-*（柱形的）和 *panorpodes*（中生蝎蛉科中模式属 Mesopanorpodes 一词的词基）。

宽翅柱状蝎蛉，新种 Stylopanorpodes eurypterus **gen. et sp. nov.**（图 1~ 4，13）

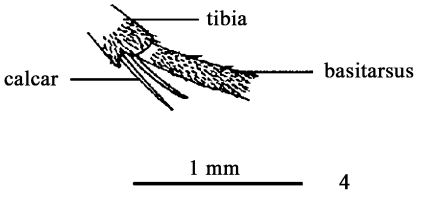
正模：一块保存完整的雌虫标本，编号：CNU-M-NN-2006005。

产地及层位：内蒙古宁城，中侏罗世九龙山组。

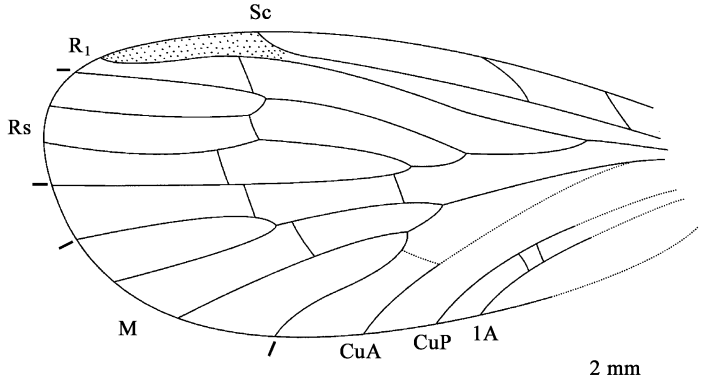
描述　虫体中等大小，长11 mm，标本展现了虫体的整个侧面，左前翅折叠到身体腹面，可见大部分翅脉，右前翅轻微折叠到身体上，后翅折叠在一起，翅脉不可分辨。



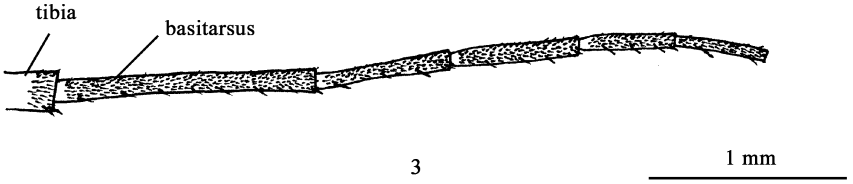

1




4




2




3

图 1~ 4　宽翅柱状蝎蛉新种 *Stylopanorpodes eurypterus* gen. *et* sp. nov.，正模，雌性（holotype, female）CNU-M-NN-2006005
1. 虫体（body）　2. 左前翅翅脉（left forewing）　3. 后足跗节（hind tarsus）　4. 后足胫端距（calcar of hind leg）

头部顶端突起, 喙细长, 复眼位于头后, 非常突出, 触角缺失。前胸背板小, 中后胸背板明显较大。足细长, 其上密布排列不规则的细毛, 基节清晰, 明显分为基节前片和后基片, 转节小, 后足胫节明显长于股节, 末端有 2 个胫端距, 长度相同, 跗节 5 节, 基跗节最长, 大约是第 2 跗节的两倍长。

翅较宽大, 长11 mm, 宽4 mm, 顶端钝圆, 最宽处在翅中点之外, 前缘区较宽, 翅痣模糊, Sc 长, 2 分支, 延伸到翅痣区域, $R_1$ 简单, 不分支, 伸达翅缘, 在接近末端处弯曲; Rs 脉 4 分支, 分叉早于 M 脉, 在翅中点之前分出它的两条主脉, $R_{4+5}$ 分叉早于 $R_{2+3}$, M 脉从翅基部发出, 4 分支, $M_{3+4}$ 早于 $M_{1+2}$ 分叉, 但晚于 $R_{4+5}$, CuA 脉基部与 M 脉愈合较长一部分, 形成 Y 形脉; CuP 脉简单, 与 CuA 脉分离, 1A 简单, CuP 和 1A 脉之间有 2 支横脉, 2A, 3A 没有保存。后翅只有部分保存, 翅脉不清。

腹部延长, 圆柱状, 末端变细, 可见 11 节, 第 1 腹节与后胸愈合, 缩小, 9~ 11 腹节明显比 2~ 8 节细, 尾须不明显。

词源: *eurypterus* 为拉丁词, 宽翅的。

纺锤蝎蛉属, 新属 Netropanorpodes **gen. nov.**

模式种: *Netropanorpodes decorosus* gen. *et* sp. nov.

鉴别特征 虫体中等, 喙细长, 下颚须 4 节, 复眼大, 触角丝状, 多节, 柄节短粗, 鞭节细长。足细长, 其上披有浓密的细毛, 不规则排列。前翅翅痣清晰, Sc 脉 2 分支, 伸达翅痣, $R_1$ 脉不分支, Rs 脉 4 分支, 在接近翅中点处分叉, 与 M 脉的第 1 次分叉几乎在同一水平处。M 脉 4 分支, $M_{3+4}$ 早于 $M_{1+2}$ 分叉。CuA 和 M 脉在基部愈合的距离较长, 两脉形成的 Y 形脉有变化。CuP 和 1A 脉之间无横脉, 但 1A 和 2A 之间有 2 支横脉。后翅 Sc 脉短, 没有伸达翅痣, CuA 和 M 脉在基部愈合的部分更长。腹部纺锤形, 雄虫腹节可见 10 节, 雌虫可见 11 节。

比较 新属与 *Stylopanorpodes* gen. nov. 类似, 但新属前翅翅痣清晰, Rs 脉和 M 脉在同一水平处分叉, 1A 和 2A 之间有 2 支横脉, 后足基跗节较长而与后者明显不同。新属也可以通过 Rs 脉和 M 脉在同一水平处开始分叉, Rs 脉和 M 脉区域的一支横脉极度退化与其它属区别开来。

词源: Netropanorpodes 源于希腊词 netro-(纺锤形的)和 panorpodes(中生蝎蛉科中模式属 Mesopanorpodes 一词的词基)。

华美纺锤蝎蛉, 新种 Netropanorpodes decorosus **gen. et sp. nov.** (图 5~ 8, 14)

正模: 一块保存完整的雄虫标本, 编号: CNU-M-NN-2006100。

产地及层位: 内蒙古宁城, 中侏罗世九龙山组。

描述 虫体较大, 体长12.5 mm, 标本展现了虫体的整个侧面, 4 个翅折叠在身体腹部, 只有前翅的翅脉清晰可见。

头部顶端隆起, 头壳延长, 与唇基、上唇和下颚形成延长的喙, 喙细长; 复眼发达, 触角丝状, 可见 11 节, 柄节短粗, 鞭节细长。

前胸背板小, 中后胸背板明显发达。足细长, 其上密布排列不规则的细毛, 基节非常清晰, 明显可见基节前片和后基片, 转节小, 后足胫节明显比股节长, 末端可见 1 个胫端距, 跗节 5 节, 基跗节最长。

翅相当大, 长12 mm, 宽4 mm, 顶端圆; 前缘区没有扩大, 翅痣清晰, 延伸到 $R_1$ 脉之下; Sc 脉长, 2 分支, 与 Rs 首次分叉几乎在同一水平处, 前一分支短, 类似横脉, 后一分支长, 延伸到翅痣区域, 亚前缘区非常狭窄; $R_1$ 简单, 不分支, 伸达翅缘, 在接近末端处成 S 形弯曲; Rs 脉 4 分支, 在接近翅中点处开始分叉, 与 M 脉的第 1 次分叉在同一水平处, $R_{4+5}$ 与 $R_{2+3}$ 在同一水平处分叉; M 脉 4 分支, $M_{3+4}$ 分叉早于 $M_{1+2}$, 且早于 $R_{4+5}$ 分叉, Rs 和 M 脉之间的区域较阔, CuA 与 M 脉在基部愈合较短一段距离, Y 形脉明显, CuP 简单, 远离 CuA, 1A, 2A 简单, 两脉之间有 2 条横脉, 3A 简单。后翅翅脉不清。

腹部纺锤形, 前 9 节明显, 第 10 节与第 9 节愈合, 末端可见尾须, 只有 1 节, 末端具有一簇感觉毛; 生殖基节明显, 生殖刺突末端尖细, 可见一对阳基侧突。

词源: decorosus 为拉丁词, 华美的。

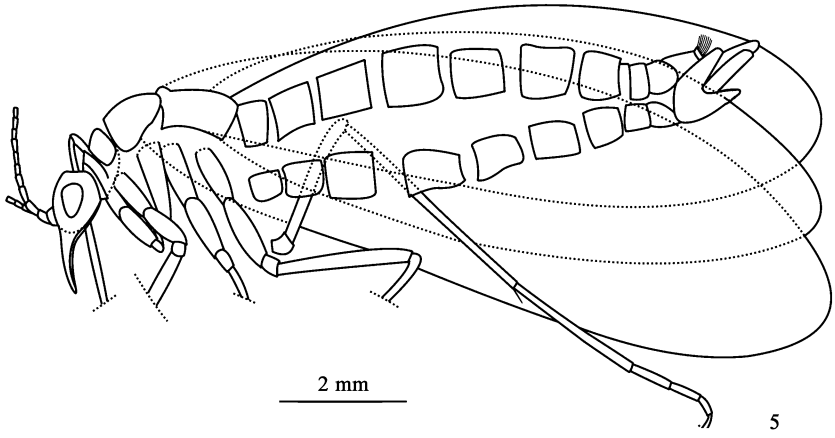
多刺纺锤蝎蛉, 新种 Netropanorpodes sentosus **gen. et sp. nov.** (图 9~ 12, 15)

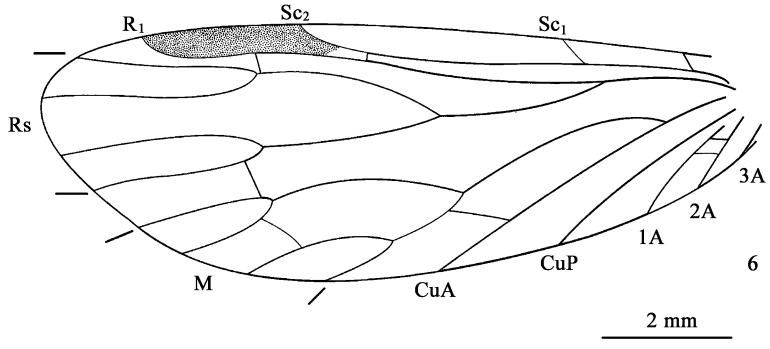
正模: 一块保存完整的雌虫标本, 编号: CNU-M-NN-2006026。

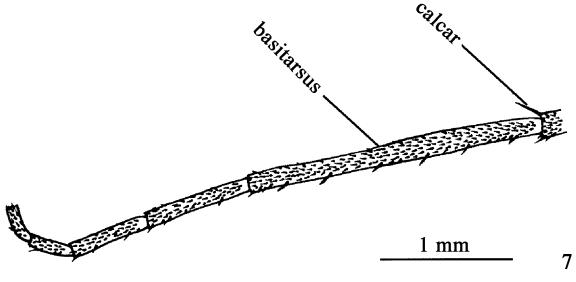
产地及层位: 内蒙古宁城, 中侏罗世九龙山组。

描述 虫体中等, 长11 mm, 标本展现了虫体的整个侧面, 左前翅向身体背面轻微延伸, 右后翅轻微折叠到身体上, 两翅臀区翅脉不可见, 另外两翅折叠在一起, 翅脉不可分辨。

头部顶端突起, 喙细长, 下颚须 4 节, 复眼大, 触角可见 17 节, 柄节短粗, 鞭节细长, 分节明显。前中胸背板较大, 后胸背板较小。足细长, 其上密布排列不规则的细毛, 前中足基节清晰, 明显分为



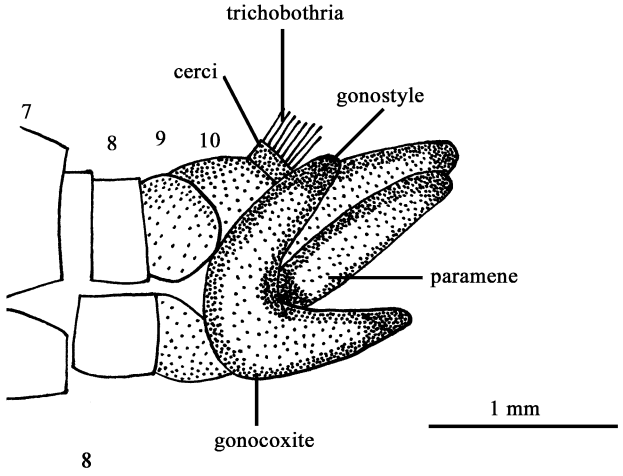
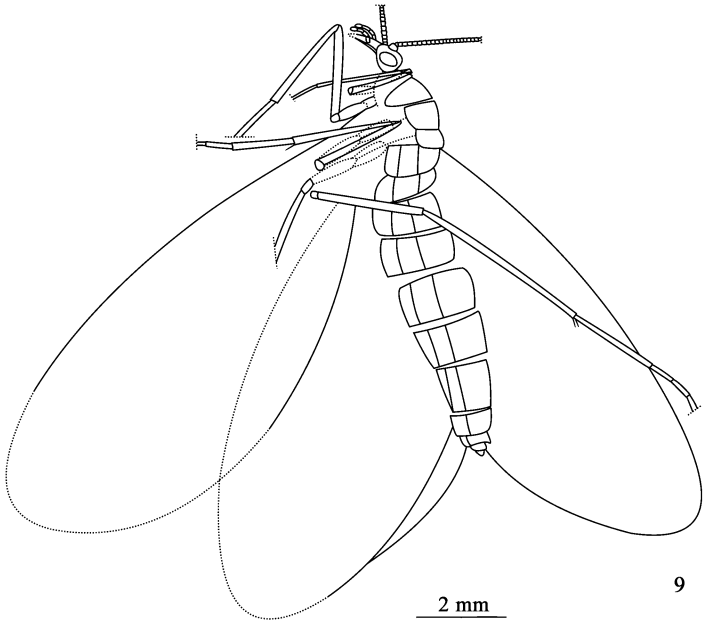
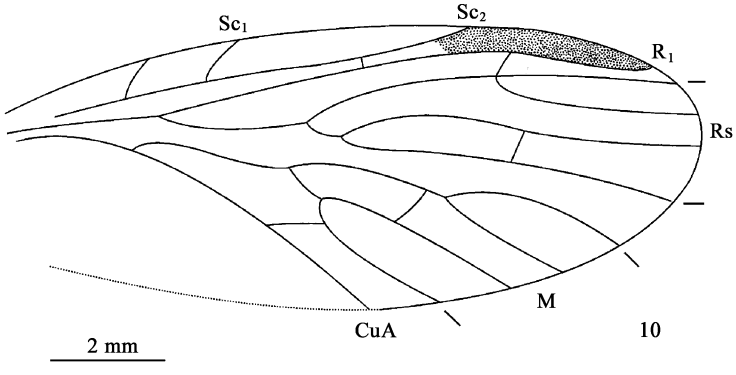
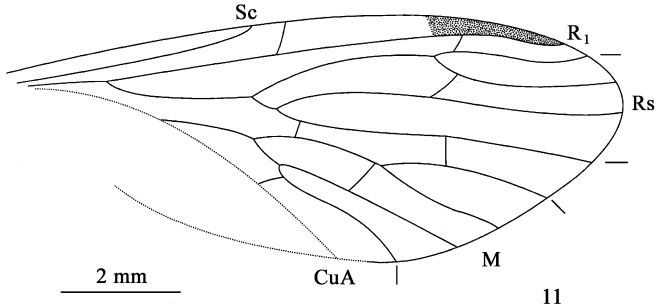




图 5~8 华美纺锤蝎蛉 *Netropanorpodes decorosus* gen. *et* sp. nov., 正模, 雄性 (holotype, male) CNU-MEC-NN-2006100
5. 虫体 (body) 6. 前翅翅脉 (forewing) 7. 后足跗节 (hind tarsus) 8. 雄性外生殖器 (genitalia of the male)



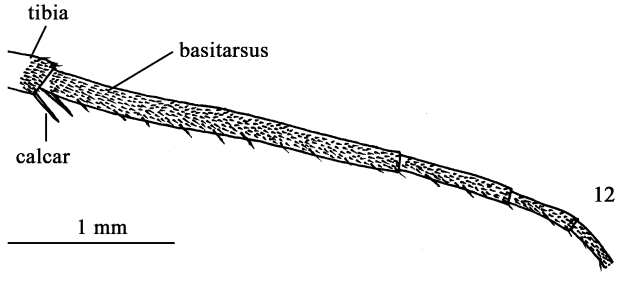




图 9~ 12　多刺纺锤蝎蛉 *Netropanorpodes sentosus* gen. *et* sp. nov.，正模，雌性（holotype, female）CNU-M-NN-2006026

9. 虫体（body）　10. 前翅翅脉（forewing）　11. 后翅翅脉（draw line of the hindwing）　12. 后足跗节（hind tarsus）

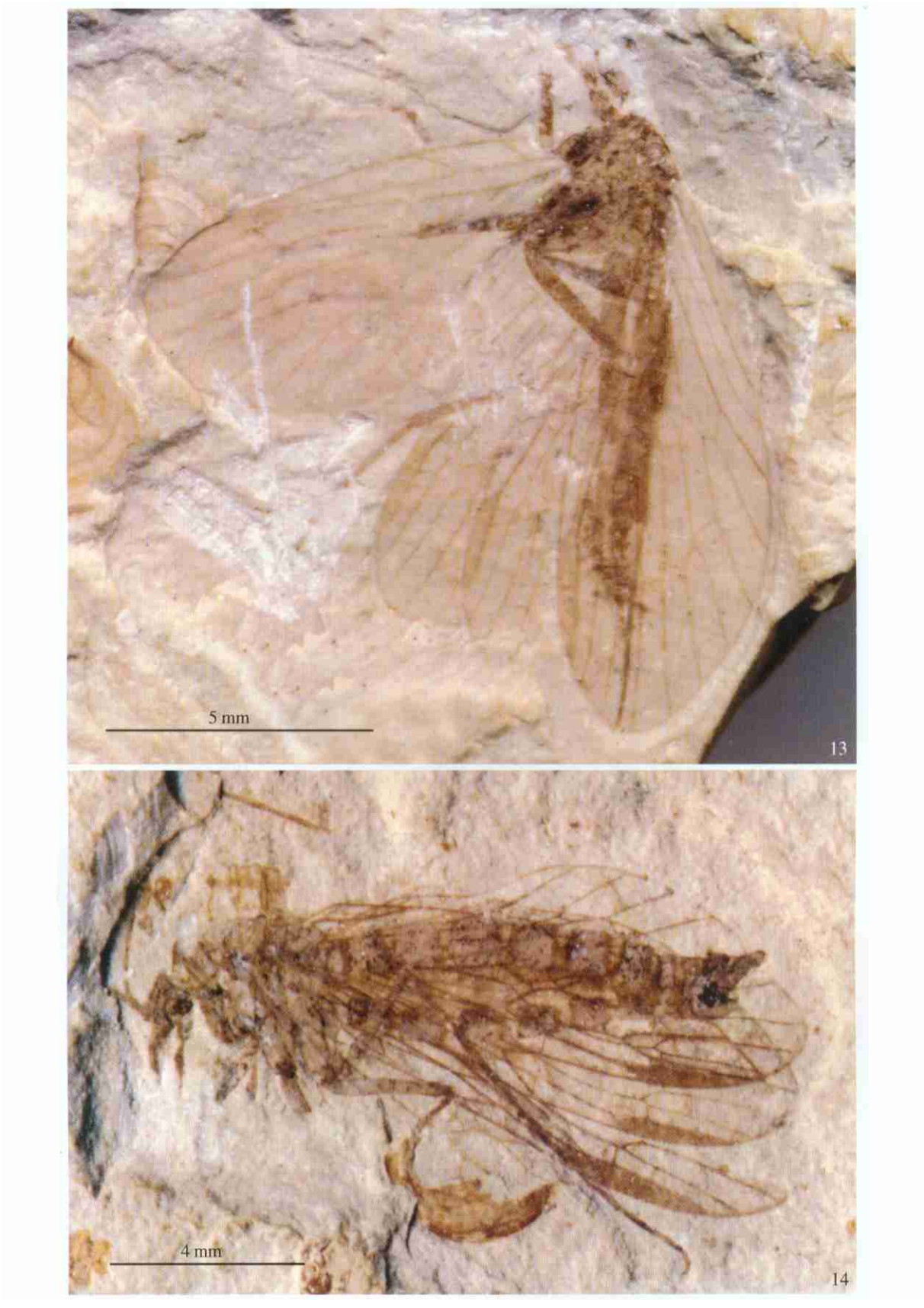



图 13 宽翅柱状蝎蛉 *Stylopanorpodes eurypterus* gen. *et* sp. nov., 正模, 雌性 (holotype, female) CNU-M-NN-2006005
图 14 华美纺锤蝎蛉 *Netropanorpodes decorosus* gen. *et* sp. nov., 正模, 雄性 (holotype, male) CNU-M-NN-2006100

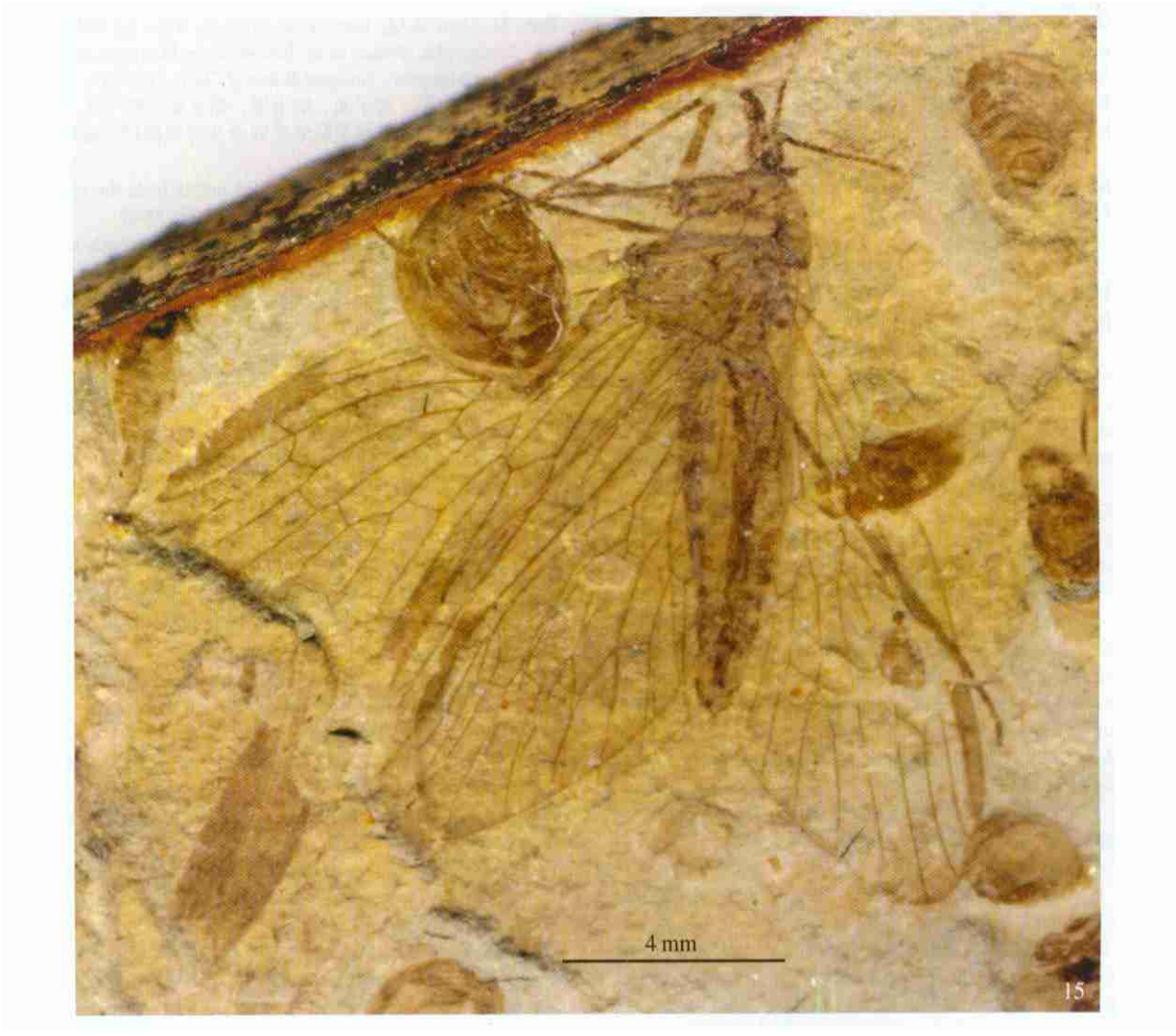



图 15 多刺纺锤蝎蛉 *Netropanorpodes sentosus* gen. *et* sp. nov., 正模, 雌性 (holotype, female) CNU-M-NN-2006026

基节前片和后基片, 股节细长, 几乎与胫节等长; 转节小, 后足基节不可见, 胫节明显长于股节, 末端有2个胫端距, 长度相同, 跗节可见4节, 基跗节最长, 大约是第2跗节的两倍长。

前翅较宽, 长11.5 mm, 宽4.5 mm, 顶端较圆; 前缘区扩展, 翅痣清晰, 延伸到 $R_1$ 脉之下; Sc 脉长, 2分支, 前一分支短, 后一分支延伸到翅痣区域, $R_1$ 简单, 不分支, 伸达翅缘, 在接近末端处成S形弯曲; Rs 脉4分支, 在翅中点之前开始分叉, $R_{4+5}$ 分叉早于 $R_{2+3}$, 且与 $M_{3+4}$ 几乎在同一水平处开始分叉; M 脉从翅基部发出, 4分支, 分叉与 Rs 脉在同一水平处, $M_{3+4}$ 分叉早于 $M_{1+2}$, $M_{1+2}$ 分离晚于 $R_{4+5}$, 但早于 $R_{2+3}$, CuA 与 M 脉在基部愈合很长一段距离, 由此形成的Y形脉明显, CuP 脉和 A 脉没有保存。后翅明显小于前翅, 但比前翅略宽, Sc 脉短, 只有1支, Cu 脉和 A 脉不可见, 其它翅脉与前翅类似。

腹部延长, 末端尖细, 明显有11节, 9到11节每一节都有部分压缩到前一节中, 尾须不可见。

比较 新种前翅 Sc 脉第1分支明显, $R_{4+5}$ 分叉早于 $R_{2+3}$, 且与 $M_{3+4}$ 几乎在同一水平上开始分叉与 *Netropanorpodes decorosus* sp. nov. 明显不同。

词源: sentosus 为拉丁词, 多刺的。

致谢 在本文完成过程中得到了本实验室刘玉双、刘明、谭京晶、王莹、黄建东、王田田、李连梅、赵亚男等同学的帮助, 在此表示感谢。

## REFERENCES (参考文献)

Carpenter, F. M. 1992. Mecoptera. *In*: Treatise on Invertebrate Paleontology, Part R, Arthropoda. 4, 3, 4. Geol. Soc. America Inc. and Univ. Kansas, Boulder, Colorado and Laurence. pp. 38-395.

Chou, I and Hua, B-Z 1999. Mecoptera. *In*: Zheng, L-Y and Gui, H (eds.), Insects Classification. Nanjing Normal University Press, Nanjing. 666-673. [周 尧, 花保祯, 1999. 长翅目. 郑乐怡, 归鸿 (主编), 昆虫分类. 南京: 南京师范大学出版社. 666~673]

Grimaldi, D. and Engel, M. 2004. Evolution of the Insects, Part 12,

Arthropoda. pp. 468-480.
Hong, Y-C, Guo X-R and Wang, W-L 2002. Middle Triassic new fossils of Mesopanorpadidae (Insecta: Mecoptera) from Tongchuan of Shaanxi Province, China. *Acta Zootax. Sin.*, 27 (2): 278-283. [洪友崇, 郭新荣, 王文力, 2002. 陕西铜川中三叠世中生蝎蛉科新化石属种 (昆虫纲: 长翅目). 动物分类学报, 27 (2): 278~283]
Hong, Y-C and Guo, X-R 2003. Two new Middle Triassic genera and species of Mesopanorpadidae (Insecta: Mecoptera) from Shaanxi Province, China. *Acta Zootax. Sin.*, 28 (4): 716-720. [洪友崇, 郭新荣, 2003. 陕西中三叠世中生蝎蛉科两新属和新种 (昆虫纲, 长翅目). 动物分类学报, 28 (4): 716~720]
Hong, Y-C 2007. Midtriassic new genera and species of Mecopanorpodidae (Insecta, Mecoptera) from Shaanxi, China. *Acta Zootax. Sin.*, 32 (2): 261-267. [洪友崇, 2007. 中国陕西中三叠世中蝎蛉科三新属新种 (昆虫纲, 长翅目). 动物分类学报, 32 (2): 261~267]
Jell, P. A. and Duncan, P. M. 1986. Invertebrates, mainly insects, from the freshwater, lower Cretaceous, Koonwarra fossil bed (Korumburra Group), South Gippsland, Victoria. *Mem. Ass. Australas. Palaeontols*, 3: 111-205.
Liu, Y-S, Ren, D, Sinitshenkova, N. D. and Shih, G-K 2006. A new Middle Jurassic Stonefly from Daohugou, Inner Mongolia, China (Insecta: Plecoptera). *Annales Zoologica* (Warszawa), 56 (3): 549-554.
Martynova, O. M. 1962. Order Mecoptera. Scorpionflies. *In*: Rohdendorf, B. B. (ed.), Osnovy. Paleontologii. *Tracheinyei khelitseraye*. Akad. Nauk. SSSR, Moscow: 283-294 (in Russian, English translation: Rohdendorf, B. B. 1962 Fundamentals of Palaeontology 9. Arthropoda, Tracheata, Chelicerata. Amerind Publ. Co., New Dehli 1991: 405-424)
Novkshonov, V. G. 1997. New and little known Mesozoic Nannochoristidae (Insecta: Mecoptera). *Vestnik Permskogo Univ.*, 4: 124-136 (in Russian).
Rasnitsyn, A. P. and Quicke, D. L. J. 2002. History of Insects. Kluwer Academic Publisher, Norwell. pp. 194-209.
Ren, D, Lu, L-W, Guo, Z-G and Ji, S-A 1995. Faunae and stratigraphy of Jurassic-Cretaceous in Beijing and the Adjacent Areas. Seismic Publishing House, Beijing. 91-94. [任 东, 卢立五, 郭子光, 姬书安, 1995. 北京与邻区侏罗-白垩纪动物群及其地层. 北京: 地震出版社. 91~94]
Ren, D, Gao, K-Q, Guo, Z-G, Ji, S-A, Tan, J-J and Song, Z 2002. Stratigraphic division of the Jurassic in the Daohugou area, Ningcheng, Inner Mongolia. *Geological Bulletin of China*, 21 (8-9): 584-591. [任 东, 高克勤, 郭子光, 姬书安, 谭京晶, 宋 卓, 2002. 内蒙古宁城道虎沟地区侏罗纪地层划分及时代探讨. 地质通报, 21 (8~9): 584~591]
Riek, E. F. 1953. Fossil Mecopteroid insects from the upper Permian of New South Wales. *Rec. Aust. Mus.*, 23: 55-87.
Riek, E. F. 1955. Fossil insects from the Triassic beds at Mt. Crosby, Queensland. *Austral. J. Zool.*, 3: 654-691.
Riek, E. F. 1974. Upper Triassic insects from the Molteno Formation, South Africa. *Paleontol. Africana*, 17: 19-31.
Riek, E. F. 1976a. New Upper Permian insects from Natal, South Africa. *Ann. Natal. Mus.*, 22: 755-789.
Riek, E. F. 1976b. A new collection of insects from the Upper Triassic of South Africa. *Ann. Natal. Mus.*, 22: 791-820.
Sukatsheva, I. D. 1985. Jurassic scorpionflies of South Siberia and West Mongolia. *In*: Rasnitsyn, A. P. (ed.), Yurskie nasekomye Sibirii Mongolii (Jurassic Insects of Siberia and Mongolia). Trudy. Paleontol. Inst. Akad. Nauk. SSSR 211. Nauka, Moscow. 96-114 (in Russian).
Tan, J-J, Ren, D and Shih, G-K 2006. New cupedids from the Middle Jurassic of Inner Mongolia, China (Coleoptera: Archostemata). *Annales. Zoologica* (Warszawa), 56: 1-6.
Tillyard, R. J. 1918. Permian and Triassic insects from New South Wales in the collection of Mr. John Mitchell. *Proc. Linn. Soc. N. S. Wales*, 42: 720-756.
Tillyard, R. J. 1926. Kansas Permian insects. 7, The Order Mecoptera. *Amer. Sci.*, 11: 133-164.
Willmann, R. 1987. The phylogenetic system of the Mecoptera. *Systematic. Entomology*, 12: 519-524.
Yao, Y-Z, Cai, W-Z and Ren, D 2006. The first discovery of fossil rhopalids (Heteroptera: Coreoidea) from Middle Jurassic of Inner Mongolia, China. *Zootaxa.*, 1269: 57-68.
Zhang, K-Y, Yang, D and Ren, D 2006. The first snipe fly (Diptera: Rhagionidae) from the Middle Jurassic of Inner Mongolia, China. *Zootaxa.*, 1134: 51-57.

# MIDDLE JURASSIC MESOPANORPODIDAE FROM DAOHUGOU, INNER MONGOLIA, CHINA (INSECTA, MECOPTERA)

SUN Jiarr-Hai, REN Dong*, SHIH Chung-Kun
*College of Life Science, Capital Normal University, Beijing* 100037, *China*

**Abstract** Two new genera and three new species, *Stylopanorpodes eurypterus* gen. *et* sp. nov., *Netropanorpodes decorosus* gen. *et* sp. nov. and *Netropanorpodes sentosus* gen. *et* sp. nov., are described. All fossil specimens were collected from the Middle Jurassic Jiulongshan Formation of Inner Mongolia in China and deposited in the Capital Normal University.

Stylopanorpodes **gen. nov.**

Type species. *Stylopanorpodes eurypterus* gen. *et* sp. nov.

Diagnosis. Moderate-sized insect, rostrum long and slender. Eyes large. Legs slender, covered with dense and tiny hairs, irregular arrangement. The forewing broad, pterostigma not distinctly. Sc long, 2-branched, reaching the pterostigmal region. $R_1$ not branched, Rs 4-branched, forking before midwing, $R_{4+5}$ forking before $R_{2+3}$. M 4-branched, which forks later than Rs; $M_{3+4}$ forking before $M_{1+2}$. CuA and M fused basally for a long distance, cubito-median Y-vein present. 2 crossveins between CuP and A1 present. Abdomen elongate, cylindrical, tapering apically, in the female 11 segments visible.

Comparison. In the general venation scheme the *Stylopanorpodes* gen. nov. somewhat resembles *Mesopanorpodes* Tillyard, 1918 and *Prochoristdla* Riek, 1953, but the new genus differs from the former by $R_{4+5}$ forking before $R_{2+3}$, two cross-veins between 1A and CuP present, and differs from the latter by Rs forking before M, $R_{2+3}$ forking later, both $R_2$ and $R_3$ shorter, the cross-vein between CuA and CuP absent. The new

* Corresponding auther, E-mail: rendong@mail.cnu.edu.cn

genus also may be distinguished from other genera by the forking of Rs and M, and the cross-veins in apical area of Rs and M strongly degenerated.

Etymology. The genus name is a combination of styl- (Greek, meaning cylindrical) and panorpodes (the holotype genus *Mesopanorpodes* in this family).

Stylopanorpodes eurypterus **gen. et sp. nov.** (Figs. 1-4, 13)

Etymology. Eurypterus from Latin, means broad wing.

Holotype. A well preserved female insect. Registration No: CNU-M-NN-2006005.

Locality and horizon. Daohugou Village, Ningcheng County, Inner Mongolia, China; Jiulongshan Formation, Middle Jurassic.

Description. Medium-sized insect, length 11mm. The specimen shows a lateral view of the whole insect. The left forewing spreading out ventrad to the body. The right forewing slightly overlapping the body. The hind wings folded together, venation not discernible.

Vertex of the head raised, with extremely large protruding eyes at anterior of head. Rostrum slender and long. Antennae missing.

Pronotum small, meso- and metanotum distinctly bigger. Legs slender and long, covered with dense and tiny hairs, irregularly arranged. Coxae very clear, which are divided distinctly into eucoxae and mera. Trochanters small. Hind tibia obviously longer than femora, with 2 terminal calcars, about equal in length. Tarsus 5-segmented, basitarsus longer than others, about two times as long as the second tarsomere.

Forewing length 11 mm, width 4 mm, apex evenly rounded, widest somewhat beyond the middle. Costal space expanded. Pterostigma not distinct. Sc long, 2-branched, extending to the pterostigmal region. $R_1$ simple, not branched, reaching the wing margin, curving posteriorly near its termination. Rs 4-branched, dividing into its two main branches before midwing, which forks ealier than M, $R_{4+5}$ forking before $R_{2+3}$. M arising from the base of the wing, 4-branched, $M_{3+4}$ forking before $M_{1+2}$, which forks after the forking of $R_{4+5}$. CuA and M fused basally for a long distance, cubito-median Y-vein present. CuP simple, well separated from CuA. 1A simple, 2 cross-veins between CuP and 1A present. 2A, 3A not preserved. The hind wing only partially preserved, venation not discernible.

Abdomen long, cylindrical, with tapering termination, 11 segments visible. Basitergum fused to metathorax, slightly shortened, the 9th to 11th segments abruptly more slender than 2-8, the cercus not clear.

Netropanorpodes **gen. nov.**

Type species. Netropanorpodes decorosus gen. *et* sp. nov.

Diagnosis. Moderate-sized insect, rostrum long and slender, maxillary palp 4-segmented. Eyes large. Antennae filiform, many-segmented, with short, stout scape and long slender flagellum. Legs slender and long, covered with dense and tiny hairs, irregular arrangement. The forewing pterostigma clearly present. Sc long, 2-branched, reaching the pterostigmal region. $R_1$ not branched, Rs 4-branched, forking nearly midwing, which forks nearly on the same level with M. M 4-branched, $M_{3+4}$ forking before $M_{1+2}$. CuA and M fused basally for a long distance, cubito-median Y-vein variable. 2 cross-veins between 1A and 2A present. The hind wing Sc shorter, not reaching the pterostigmal region. Abdomen fusiform, in the male 10 segments visible, and female 11 segments visible.

Comparison. The new genus is similar to *Stylopanorpodes* gen. nov. However, the new genus forewing with clear pterostigma, Rs and M forked on the same level, two cross-veins between 1A and 2A present, the hind basitarsus longer, which is distinct from the later. The new genus also could be distinguished from other genera by Rs and M forked on the same level, and the cross-veins in the area of Rs and M strongly degenerated.

Etymology. The genus name is a combination of netro- (Greek, meaning fusiform) and panorpodes (the holotype genus *Mesopanorpodes* in this family)

Netropanorpodes Decorosus **gen. et sp. nov.** (Figs. 5-8, 14)

Etymology. Decorosus from Latin, means gorgeous.

Holotype. A well preserved male insect. Registration No: CNU-M-NN-2006100.

Locality and horizon. Daohugou Village, Ningcheng County, Inner Mongolia, China; Jiulongshan Formation, Middle Jurassic.

Description. Relatively large insect, long 12.5 mm. The specimen shows a lateral view of the whole insect. The four wings folded together over the abdomen, showing only faint traces of the veins. Only venation of forewing is discernible from the four overlapped wings.

Vertex of the head raised, the head capsule elongate, together with the clypeus, labrum and maxillae forms the prolonged rostrum, relatively slender and long. Compound eyes well developed. Antennae filiform, 11 segments visible, with short, stout scape and long slender flagellum.

Pronotum small, meso- and metanotum distinctly developed. Legs slender and long, covered with dense and tiny hairs, irregular arrangement. Coxae very clear, which are divided distinctly into eucoxae and mera. Trochanters small. Hind tibia obviously longer than femora, 1 terminal calcar visible. Tarsus 5-segmented, basitarsus longer than others.

Forewing considerably large, length 12 mm, width 4

mm, apex rounded. Costal space not expanded. Pterostigma clearly present. Sc long, 2-branched, forking nearly on a level with the origin of Rs, the upper branch short, almost transverse, the lower long, extending to the pterostigmal region, subcostal space very narrow. $R_1$ simple, not branched, reaching the wing margin, sigmoidally curved. Rs 4-branched, dividing into its two main branches nearly midwing, which forks nearly on the same level with M, $R_{4+5}$ forking on a level with $R_{2+3}$. M 4-branched, $M_{3+4}$ forking before $M_{1+2}$, which forks before the forking of $R_{4+5}$, the space between Rs and M very wide. CuA coalesced with M for a short distance basally, Cubito-median Y-vein present, having longer arm to CuA than to M, CuP simple, well separated from CuA. 1A, 2A simple, 2 cross-veins between them present. 3A simple. The veins of hind wing not discernible.

Abdomen somewhat spindle-shaped, with 9 apparent segments, the 10th segment probably fused to the 9th segment, 1-segmented cersus visible, the termination of the cersus with a cluster of distinct trichobothria. Gonocoxites evident, gonostyle tapering, visible a pair of paramenes.

*Netropanorpodes sentosus* **gen. et sp. nov.** (Figs. 9-12, 15)

Etymology. Sentosus from Latin, means many setae on the legs.

Holotype. A well preserved female insect. Registration No: CNU-M-NN-2006026.

Locality and horizon. Daohugou Village, Ningcheng County, Inner Mongolia, China; Jiulongshan Formation, Middle Jurassic.

Description. Medium-sized insect, length 11 mm. The specimen shows a lateral view of the whole insect. The left forewing extending dorsal to the body, the right hind wing somewhat overlapping the body. The veins in the anal area are not discernible. The other two wings folded together, the veins are not discernible.

Vertex of the head raised, rostrum slender and long, maxillary palp 4-segmented. Eyes large. Antennae 17 segments visible, with short, stout scape and long slender flagellum on which segmentation is evident.

Pro- and mesonotum slightly larger, metanotum small. Legs slender and long, covered with dense and tiny hairs, irregular arrangement. Fore and middle legs with clear coxae, which are divided distinctly into eucoxae and mera, with slender femur slightly as long as tibiae. Trochanters small. Hind leg with coxa not discernible, tibia obviously longer than femora, with 2 terminal calcars, about equal in length. Tarsus 4 segments visible, Basitarsus longer than others, about two times as long as the second tarsomere.

Forewing relatively broad, length 11.5 mm, width 4.5 mm, with rounded apical margin. Costal space expanded. Pterostigma clearly present, extending well below $R_1$. Sc long, 2-branched, upper branch short, the lower one extending to the pterostigmal region. $R_1$ simple, not branched, reaching the wing margin, sigmoidally curved near its termination. Rs 4-branched, dividing into two main branches before midwing, $R_{4+5}$ forking well before $R_{2+3}$, which almost forking on the same level with $M_{3+4}$. M arising from the base of the wing, 4-branched, forking on the same level with Rs, $M_{3+4}$ forking before $M_{1+2}$. $M_{1+2}$ forking after $R_{4+5}$, which forks before $R_{2+3}$. CuA coalesced with M for a long distance basally, cubito-median Y-vein evident. CuP and A not discernible. The hind wing smaller than forewing, but slightly broader. Sc a little shorter, only one branch. The veins of Cu and A not discernible. Other veins are similar to the forewing.

Abdomen elongate, tapering apically, with 11 clearly defined apparent segments. Each of the 9th to 11th segments is telescoped into the preceding segment, the cercus not discernible.

Comparison. The new species differs from *Netropanorpodes decorosus* sp. nov. in the following features on the forewing: the upper branch of Sc evident, $R_{4+5}$ forking well before $R_{2+3}$, which almost forking on the same level with $M_{3+4}$.

**Key words** Mecoptera, Mesopanorpodidae, new genus, new species, Daohugou, Middle Jurassic.